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| (21) International Application Number: PCT/SE00/00046 (22) International Filing Date: 13 January 2000 (13.01.00) (30) Priority Data: 9900076-2 13 January 1999 (13.01.99) SE (71) Applicant (for all designated States except US): BIOLIGHT PATENT HOLDING AB [SE/SE]; Svärdvägen 15, S-182 33 Danderyd (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): THIBERG, Rolf [SE/SE]; Åkersbergavägen 10, S-184 50 Åkersberga (SE). (74) Agents: ÖRTENBLAD, Bertil et al.; Noréns Patentbyrå AB, Box 10198, S-100 55 Stockholm (SE). | | (81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i> |
| (54) Title: DEVICE FOR EXTERNAL TREATMENT OF THE ORAL CAVITY BY MEANS OF LIGHT AND METHOD FOR MEDICAL TREATMENT <div data-bbox="487 1134 1055 1449" data-label="Image"> </div> (57) Abstract <p>Apparatus and method for external medical treatment of the oral cavity with the aid of light. The apparatus includes a light-emitting device (1), which is intended to be held against or in the close proximity of the patient's body, and means (8, 9, 10) for driving the light-emitting device. The light-emitting device includes light-emitting diodes (3, 4) or corresponding elements adapted to emit infrared (IR) light. The drive means (8, 9, 10) includes a computer (8) and circuits (9, 10) for driving the light-emitting diodes (3, 4), wherein the computer (8) is adapted to deliver electric signals to the drive circuits (9, 10). The drive means (8, 9, 10) is adapted to cause the light-emitting device (1) to emit infrared light in accordance with a series of pulse repetition frequencies. First, light that has a pulse repetition frequency of about 7.8 Hz is emitted and followed by light that has a pulse repetition frequency of about 287 Hz which is followed by light that has a pulse repetition frequency of about 31.2 Hz.</p> | | |

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DEVICE FOR EXTERNAL TREATMENT OF THE ORAL CAVITY BY MEANS OF
LIGHT AND METHOD FOR MEDICAL TREATMENT

The present invention relates to an apparatus for external
5 medical treatment of the oral cavity with the aid of light,
more specifically with the aid of light which palliates
and/or cures different states of diseases, and a method for
medical treatment.

10 Swedish Patent Specification No. 502 784 teaches for instance
an apparatus for external medical treatment with the aid of
light that includes a light-emitting device which is intended
to be held against or close to the body of an individual, and
drive means for the light-emitting device, which light
15 emitting device includes light emitting diodes or
corresponding elements which is intended to emit infrared
light. According to the aforesaid patent specification, the
drive means is adapted to control the light emitting device
to emit infrared light in a first stage and then to emit
20 visible light in a second stage. The drive means is adapted
to control the light emitting device to pulsate the infrared
light and the visible light in accordance with a
predetermined series of pulse frequencies.

25 It has also been found that very good results can be obtained
when treating a patient with solely one or more types of
monochromatic light and with light other than infrared light,
such as visible light of different colours emitted in
accordance with a given pulse frequency.

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It is also known to perform different treatments by using
certain specific pulse repetition frequencies to achieve
certain effects.

It has thus been found that an apparatus of the aforesaid kind can be used very successfully in treating many different states of diseases and injuries, for instance sport sustained injuries, stretched muscles, muscular pain, joint pain, headaches, various inflammatory conditions, various skin complaints, such as acne, back pains, etc., provided that the light is emitted in a certain way. In this regard, treatment with light has a favourable influence on injury healing processes and will palliate and/or cure various diseases.

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There is thus an understanding that treatment with certain light that is emitted in certain frequency series will have a significantly greater effect in shortening the time taken to cure or palliate a disease.

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It has surprisingly been found that an apparatus of this kind can be used to palliate and cure gingivitis, i.e. inflammation of the gums, and also pariedontitis, i.e. loosening of the teeth. The present invention relates to apparatus for this purpose.

20

Further the invention relates to a method for medical external treatment of the kind and with the main characterizing features indicated in claim 4.

25

The present invention thus relates to an apparatus for the external medical treatment of the oral cavity with the aid of light, said apparatus including a light emitting device which is intended to be held against or in the close proximity of the patient's body, and drive means for the light emitting device, wherein said light emitting device includes light-emitting diodes or corresponding elements adapted to emit monochromatic light, wherein said drive means is adapted to control the light emitting device to emit at least one type

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- of monochromatic light over one or more predetermined time periods and to pulsate the light emitted in accordance with a predetermined pulse frequency or a series of pulse frequencies over said time periods, wherein the drive means includes a computer and drive circuits for the light-emitting diodes, wherein the computer is adapted to send electric signals to the drive circuits, wherewith the light-emitting diodes function to emit light within predetermined time periods and with predetermined pulse repetition frequencies.
- 10 The invention is characterised in that the light emitting device is intended to lie against a patient's cheek; and in that the drive means and the light emitting device are adapted to emit solely infrared (IR) light in accordance with a series of pulse repetition frequencies, wherein light
- 15 having a pulse repetition frequency of about 7.8 Hz is emitted first, followed by light that has a pulse repetition frequency of about 287 Hz, followed by light that has a pulse repetition frequency of about 31.2 Hz.
- 20 The invention will now be described in more detail partly with reference to an exemplifying embodiment thereof shown on the accompanying drawing, in which
- Figure 1 is a schematic block diagram illustrating an apparatus of the present kind; and
 - 25 - Figure 2 is a side view of a light emitting device.

Figures 1 and 2 illustrate generally an apparatus for external medical treatment with the aid of light, said apparatus including a light emitting device 1 which is

30 intended to be held against or in the close proximity of the patient's body. The light emitting device is shown from one side in Figure 2 and from beneath in Figure 1. This device includes a casing 5 which houses a transparent plate 6. Located beneath the plate 6 is a surface 2 on which a

plurality of light emitting diodes 3, 4 or corresponding elements are mounted.

5 The light emitting diodes thus emit light through the plate 6 when activated, i.e. when supplied with current through a cable 7. When the device is being used, the casing 5 is held so that the plate 6 will lie against the relevant part of the patient's body.

10 The apparatus also includes drive means for operating the light emitting device 1. The drive means is adapted to control the light emitting device 1 to emit desired types of monochromatic light of different wavelengths over different predetermined time periods, and to pulsate the light emitted
15 in accordance with a predetermined pulse frequency or series of pulse frequencies over said time periods.

The light emitting device 1 may include light emitting diodes 3 adapted for the emission of infrared light. These diodes
20 are shown with solid circles in Figure 1. Visible light can be emitted with the aid of other light emitting diodes 4. These diodes are illustrated with empty circles in Figure 1.

The drive means includes a computer 8 which controls drive
25 circuits 9, 10 to which signals for driving the light emitting diodes are sent from the computer via a conductor.

The computer and the drive circuits are of a suitable known kind. The drive means or computer has connected thereto a
30 keyboard 13 by means of which the operator can key-in data which causes the drive means to activate the light emitting device in a desired manner. The apparatus will conveniently include a display 14 for displaying the settings entered

through the keyboard. This display may be the computer screen.

5 A major part of the apparatus described above is also described in the aforesaid Swedish patent specification.

According to Swedish Patent Specification No. 9900074-7 at least the drive circuits 9, 10 of the drive means are mounted in the light emitting device 1.

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According to one embodiment of the invention described in this latter patent specification, the computer 8 is integrated with the light emitting device 1. The computer 8 of this particular embodiment is preferably a microprocessor with associated memory. The computer 8 is programmed to control the light-emitting diodes to effect different treatments, via the drive circuits 9, 10.

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Thus, the computer may be separate from the light emitting device 1, as shown in Figure 1, or may be integrated with the light emitting device, as described above.

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According to the present invention, the light emitting device is intended to lie against a patient's cheek. This means in particular that the size of the illuminating or irradiating surface of the light emitting device will be adapted to the size of a normal cheek. According to the present invention, the drive means 8, 9, 10 and the light emitting device 1 are adapted to emit solely infrared (IR) light in accordance with a series of pulse repetition frequencies, where light with a pulse repetition frequency of about 7.8 Hz is emitted first and followed by light that has a pulse repetition frequency of about 287 Hz, which is followed by light that has a pulse repetition frequency of about 31.2 Hz.

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The ideal pulse repetition frequencies are 7.8 Hz, 287 Hz and 31.2 Hz respectively, although small deviations are acceptable.

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An apparatus constructed solely for treatment in the oral cavity, and then particularly for treating gingivitis and parodontitis may thus have a light emitting device that is adapted to emit solely infrared light. However, in addition to said light treatment it is conceivable to treat a patient with additional one or more types of monochromatic light either before or after administering said light treatment.

According to one preferred embodiment, the drive means 8, 9, 10 and the light emitting device 1 are adapted to emit said light for a duration of about 60 to 120 seconds with each pulse repetition frequency. This duration will preferably be about 90 seconds per pulse repetition frequency.

Treatment will thus be administered over a period of only some few minutes. The treatment is repeated on sequential occasions until the intended effect has been achieved.

According to another preferred embodiment, the infrared light has a wavelength of generally about 956 nanometers.

As mentioned in the introduction, it has been found that external treatment on the cheek of a patient in accordance with the present invention significantly palliates and cures gingivitis and parodontitis despite the fact that the light emitting device is not directed immediately onto the gums of a patient or placed against the gums. This is thought to be due to the influence of the light on the cheek tissues,

which, in turn, influences the tissues around and in the gums.

Regarding gingivitis a pilot study has been made at
5 Tandläkarhögskolan (the College of Dentistry), Huddinge,
Sweden including eight patients. Four of them were actively
treated in accordance with the present invention, and four of
them received ineffective treatment. In the placebo group no
changes were observed, but in the group that was treated in
10 accordance with the invention improvements were observed
being of a magnitude, which is clinically relevant regarding
both gingival index (41%), bleeding index (35%) and plaque
index (41%).

15 Regarding parodontitis a pilot study has been made at
Kliniken för tandlossningssjukdomar (the Clinic of
Parodontitis), Malmöhus läns landsting, Malmö, Sverige
including six seriously injured patients, who previously have
received two consecutive basic treatments of non-surgical
20 subgingival depuration, but no subsequent healing could be
measured. All patients were treated in accordance with the
present invention. When following up the results three months
later the soundable pocket depth had decreased 33%.
Patients who simultaneously had taken vitamin-mineral
25 preparations showed better improvements than the others.

In two cases of parodontitis, of which the documentation is
adequate, a treatment in accordance with the present
invention has given favourable results. Scheduled extractions
30 had to be cancelled and swaying teeth have become stable.

Although the invention has been described above with
reference to exemplifying embodiments thereof, it will be

understood that the invention can be modified with respect to the structural design of the light emitting device and possible treatment with other types of light.

- 5 It will therefore be understood that the present invention is not restricted to the aforescribed embodiments but that modifications and variations can be made within the scope of the accompanying Claims.

CLAIMS

1. Apparatus for external medical treatment of the oral cavity with the aid of light, said apparatus including a light-emitting device (1) which is intended to be held
5 against or in the close proximity of the patient's body, and means (8, 9, 10) for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes (3,4) or corresponding elements adapted to emit
10 monochromatic light, wherein the drive means (8, 9, 10) is adapted to cause the light-emitting device (1) to emit at least one type of monochromatic light over one or more predetermined time periods and to pulsate the light emitted in accordance with a predetermined pulse frequency or series
15 of pulse frequencies over said time periods, wherein said drive means (8, 9, 10) includes a computer (8) and circuits (9, 10) for driving the light-emitting diodes (3, 4), wherein the computer (8) is adapted to deliver electric signals to the drive circuits (9, 10), wherewith the light-emitting diodes (3, 4) are adapted to emit light within
20 predetermined time periods and at predetermined pulse repetition frequencies, characterised in that the light emitting device (1) is intended to be placed against the patient's cheek, and in that the drive means (8, 9, 10) and
25 the light emitting device are adapted for the emission of solely infrared (IR) light in accordance with a series of pulse repetition frequencies, wherein light that has a pulse repetition frequency of about 7.8 Hz is emitted first and followed by light that has a pulse repetition frequency of
30 about 287 Hz which is followed by light that has a pulse repetition frequency of about 31.2 Hz.

2. Apparatus according to Claim 1, characterised in that the drive means (8, 9, 10) and the light emitting device (1)

are adapted to emit said light for a duration of about 60 to 120 seconds per pulse repetition frequency.

3. Apparatus according to Claim 1 or 2, **characterised** in
5 that the infrared light has a general wavelength of about 956 nanometers.

4. A method for external medical treatment of the oral cavity with the aid of light, **characterized** in that a light
10 emitting device (1) intended to be held against or in the close proximity of the patient's body, which device is adapted to emit at least one type of monochromatic light over one or more predetermined time periods and to pulsate the light emitted in accordance with a predetermined pulse
15 frequency or series of pulse frequencies over said time periods, is caused to lie against the patient's cheek while the light emitting device is caused to emit solely infrared (IR) light in accordance with a series of pulse repetition frequencies, wherein light that has a pulse frequency of
20 about 7.8 Hz is emitted first and followed by light that has a pulse repetition frequency of about 287 Hz which is followed by light that has a pulse repetition frequency of about 31.2 Hz.

25 5. Method according to claim 4, **characterized** in that the light emitting device (1) is adapted to emit said light for a duration of about 60 to 120 seconds per pulse repetition frequency.

30 6. Method according to claim 4 or 5, **characterized** in that the infrared light has a general wavelength of about 956 nanometers.

Fig. 1

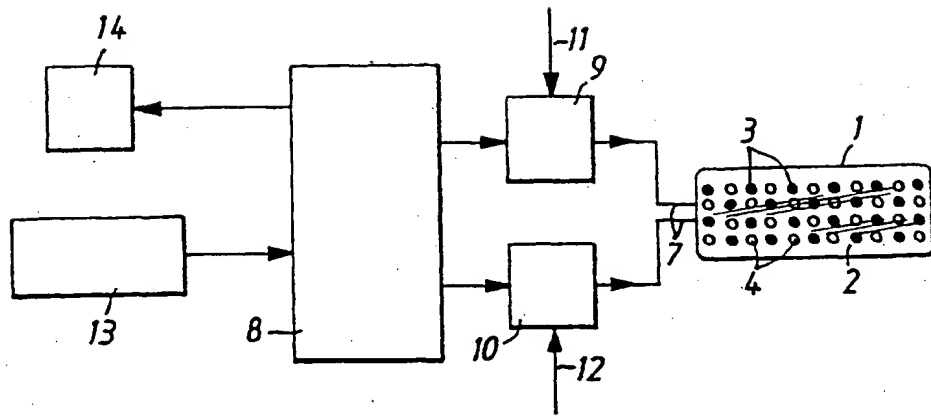
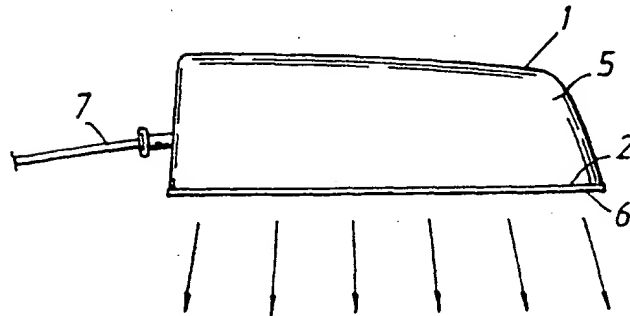


Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00046

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61N 5/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC7: A61N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X | SU 746869 A (B.B.KALYGIN ET AL), 10 July 1980 (10.07.80), column 1, line 1 - line 15; column 4, line 13 - line 21 -- | 1-6 |
| A | US 5500009 A (E.MENDES ET AL), 19 March 1996 (19.03.96), column 2, line 64 - column 3, line 13, abstract ----- | 1-6 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| SU 746869 A | 10/07/80 | NONE | |
| US 5500009 A | 19/03/96 | CA 2120457 A | 28/03/95 |
| | | US 5259380 A | 09/11/93 |
| | | US 5549660 A | 27/08/96 |